SANYO

FILE No.

Service Manual

Pharmaceutical refrigerator

MPR-414F

MPR-414FR

SANYO Electric Biomedical Co., Ltd.

SM9910022

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Effective models

This service manual is effective following models.

Model name	Model code	Voltage and Frequency	
MPR-414F	823 278 51	110/115V	60Hz
	823 278 52	220V	50Hz
	823 278 53	220V	60Hz
	823 278 54	230/240V	50Hz
	823 278 56	230/240V	50Hz
	823 278 57	220V	50Hz
	823 278 58	110/115V	60Hz
MPR-414FR	823 278 82	110/115V	60Hz

Features

1. Effectively used in a small installation space.
- The apparatus is equipped with both a refrigerator stores in +5°C and a freezer preserves in –20°C.

2. Environmental friendly
- HFC refrigerant
- PCM structure makes organic solvent usage lesser.

3. Easy operation
- The new microcomputer system is adopted to operate the display and the key pad easily.
- High / low temperature alarm (SV of refrigerator: varied in ±2°C ~ ±14°C SV of freezer: varied in ±5°C ~ ±15°C)
- Remote alarm terminal
- SV can be stored in non-volatile memory.
- Self-diagnosis system is installed. (Temperature sensors malfunctions are displayed)

4. Medical stores safety
- The door open-and-shut operation is detected by Data Collect System.

Note) Data Collect System is optionally provided.

5. Validation
- Zero adjustment can be worked on the control panel.

6. Data Collect System (option)
- An internal temperature can be recorded.

7. Product quality improved.
- For less power consumption, the factory abolishes to use heaters in foaming.
- The apparatus is provided for the function to prevent stores from being frozen in refrigerator.

Specifications

Item	MPR-414F, MPR-414FR specifications	
	Refrigerator	Freezer
External dimensions	800 mm W x 600 mm D x 1805 mm H	
Internal dimensions	720 mm W x 495 mm D x 1425 mm H	317 mm W x 440 mm D x 576 mm H
Effective capacity	340 L	82 L
Exterior	Electro-galvanized steel sheet Baked polyester resin coating (PCM)	
Interior	Stainless steel sheet	Colored aluminum
Thermal insulation	Hard polyurethane foam	
Outer doors	Electro-galvanized steel sheet, Baked acrylic resin coating	
	2 with triple-glazed windows 1 without window	1
Shelving (414F)	Hard steel wire with PE coating 3 x large, 3 x small Load capacity: 25kg / large 15kg / small	Hard steel wire with PE coating 1 Load capacity: 15kg / shelf
(414FR)	Hard steel wire with PE coating 3 x large 6 x rack Load capacity: 15kg / rack	Hard steel wire with PE coating 1 Load capacity: 15kg / shelf
Lock	Cylinder key: 2	
Casters	4	
Leveling legs	2	

Performance

Item	Specifications	
	Refrigerator	**Freezer**
Model	MPR-414F, MPR-414FR	
Cooling system	Forced air circulation	Direct cooling
Compressor	Hermetic type 160W x 2	
Refrigerant	80g, R134a	113g, R407D
Oil additive	5g	7g
Oil	Ze-NIUS32SA (HAB oil) *	
Evaporator	Fin and tube type	Tube on sheet
Condenser	Wire and tube type	Rear condenser
Condenser fan motor	2W	None
Defrost control system	Cycle defrost and evaporator temperature sensing	Natural defrost by stopping operation
Defrost heater	99W	None
Defrost water disposal	Forced evaporation using heat of condensation	None
Cooling capacity	+2℃ (ambient temp:+35℃, no load)	-30℃ (ambient temp:+30℃, no load)
Control system	Microcomputer system	
Temperature control range	+2℃～+14℃	-30℃～-20℃
Lighting	10W white bulb x 1	None
ELB	None	None
Power supply	Local voltage	

* The Ze-NIUS32SA is compatible with the CF32.

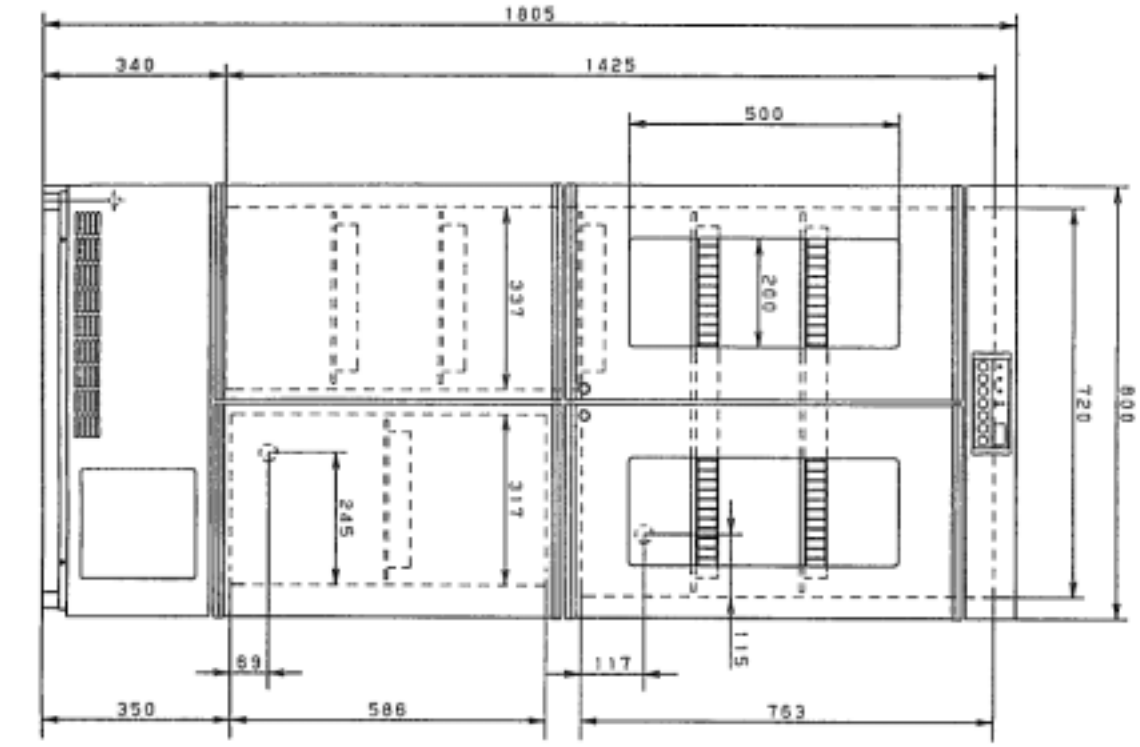
Functions

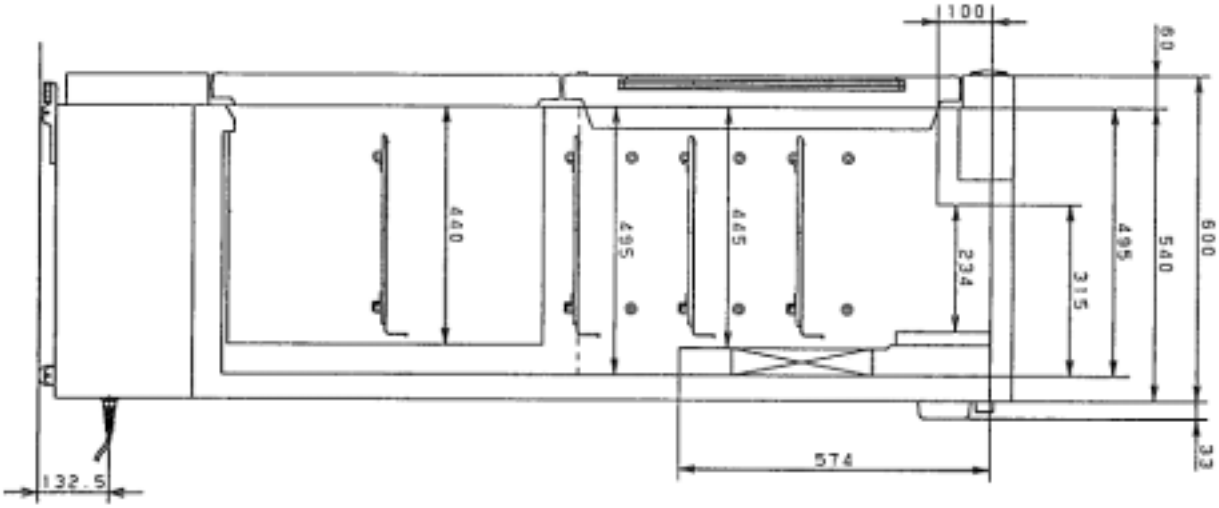
Item	Specifications	
	Refrigerator	**Freezer**
Temperature display	Digital temperature display: Green LED Display range: -50℃～+50℃ Units of 1℃	
Temperature set range	+2℃～+14℃	-35℃～-15℃
Temperature alarm (See page 10 “Control specification” for details)	High, low temp. alarm setting range: (±2～±14℃) High temp. alarm (initial set: +5℃) ⇩ In +5℃ setting, when the internal temp. reaches to 10℃, alarm and numerical display blinks. After the 15min. passed, buzzer beeps and remote alarm terminal turns ON. Low temp. alarm (initial set: -5℃) ⇩ In +5℃ setting, when the internal temp. reaches to 0℃, alarm and numerical display blinks. After the 15min. passed, buzzer beeps and remote alarm terminal turns ON. When the internal temp. is lower than 0℃ ⇩ This alarming system is different from low temp. alarm. When the internal temp. is lower than 0℃ (actually -1℃ or lower), alarm and display lamp blinks, buzzer beeps immediately, and remote alarm terminal turns ON.	High, low temp. alarm setting range: (±5～±15℃) High temp. alarm (initial set: +10℃) ⇩ In -30℃ setting, when the internal temp. reaches to -20℃, alarm and numerical display blinks. After the 15min. passed, buzzer beeps and remote alarm terminal turns ON. Low temp. alarm (initial set: -10℃) ⇩ In -30℃ setting, when the internal temp. reaches to -40℃, alarm and numerical display blinks. After the 15min. passed, buzzer beeps and remote alarm terminal turns ON.
Low temp. protection	When the internal temperature reaches to approx. –1℃, low temp. alarm thermostat activates and compressor turns OFF. This function is different from low temp. alarm’s.	
Door alarm	DOOR lamp illuminates. Buzzer beeps 2min. after Door lamp illuminates.	
Remote alarm contact	Contact capacity 30VDC, max. 2A NO-COM (in temperature alarm activating, and during a power failure)	

Self-diagnostic functions	On refrigerator temperature control sensor, freezer temperature control sensor and defrost sensor malfunction: ● Both error code and internal temperature are displayed alternately. ● Remote alarm contact ON, buzzer alarm is triggered.	
Security functions	When an internal temperature rises to 28℃, the bimetal thermostat activates then the heater and the internal fan motor are turned off. When an internal temperature drops in -1℃, the gas thermostat activates then the compressor is turned off.	
Operation panel	DOOR lamp ALARM lamp REFRIGERATOR / FREEZER lamp BUZZER key SET key ＞key: Move set digit ∧key: Change setting Defrost key REF. / FREEZ. key	
Key lock functions	Press the ＞key for around 5 seconds L0: Release lock L1: Lock	
Function mode	See page 13 “9. Function Mode” for details.	

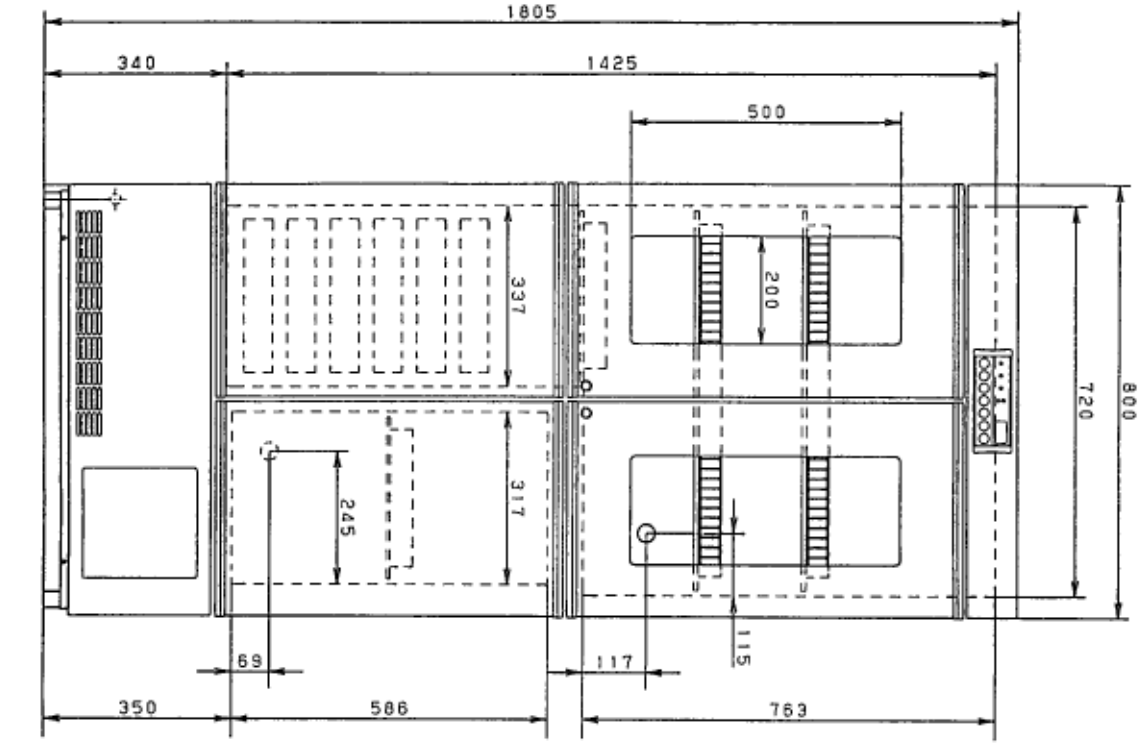
Dimension

MPR-414F





MPR-414FR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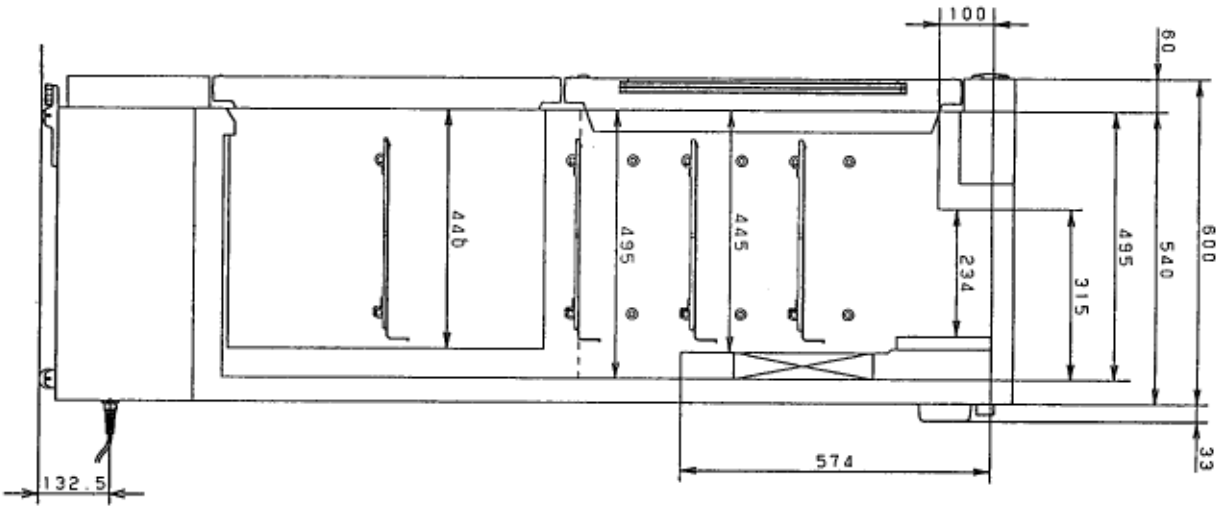
763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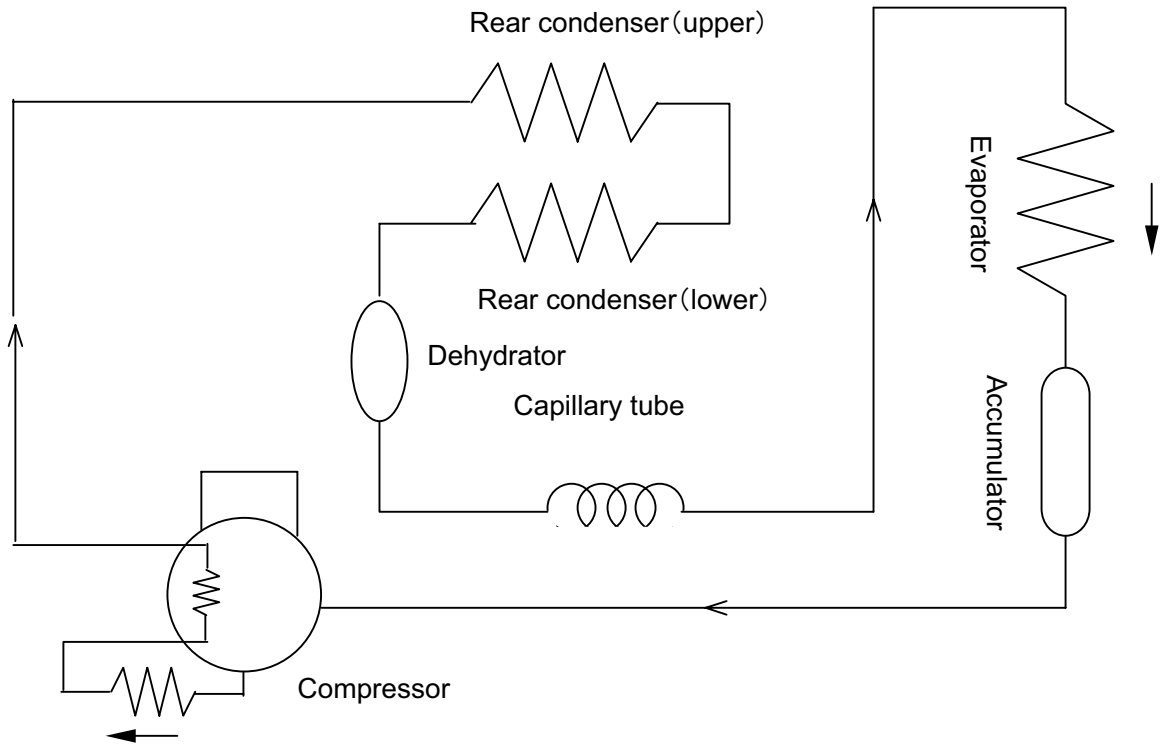
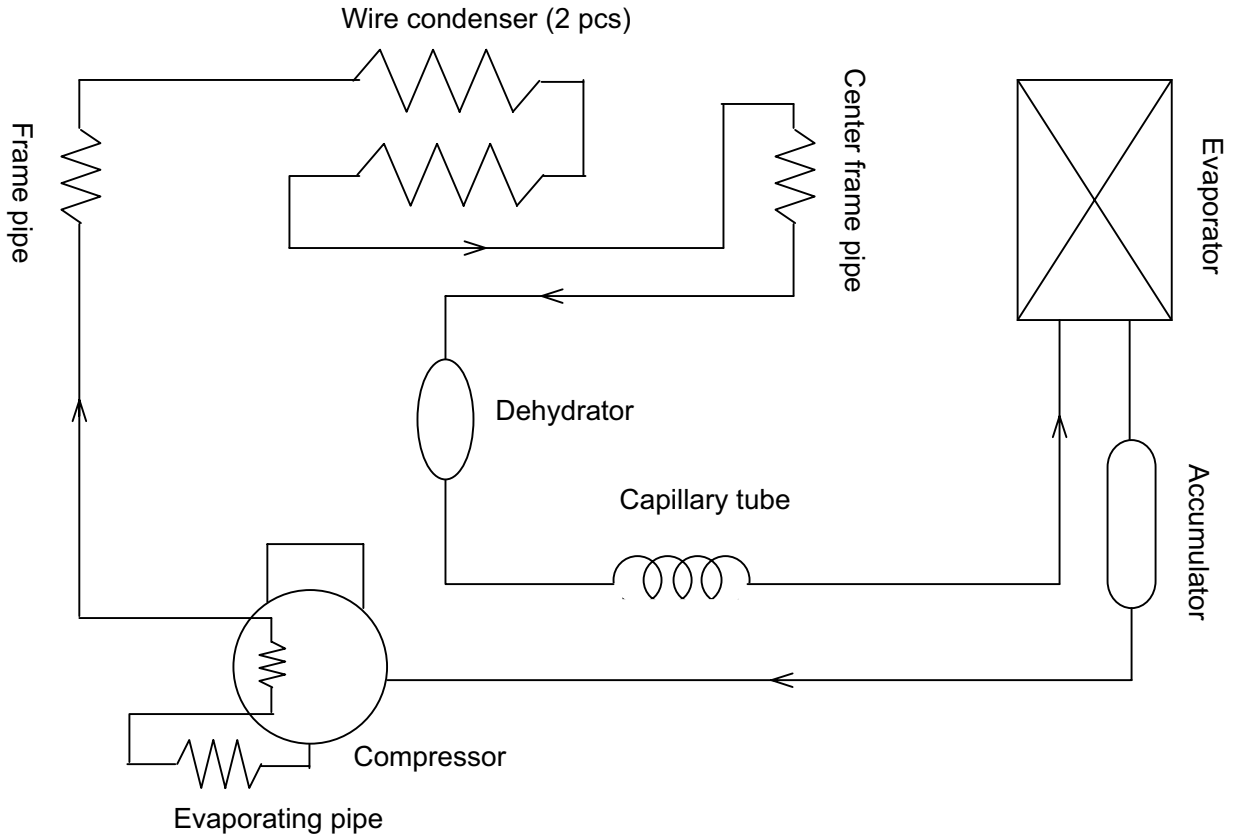
574
132.5
33

Refrigeration circuit principle diagram

MPR-414F Freezer

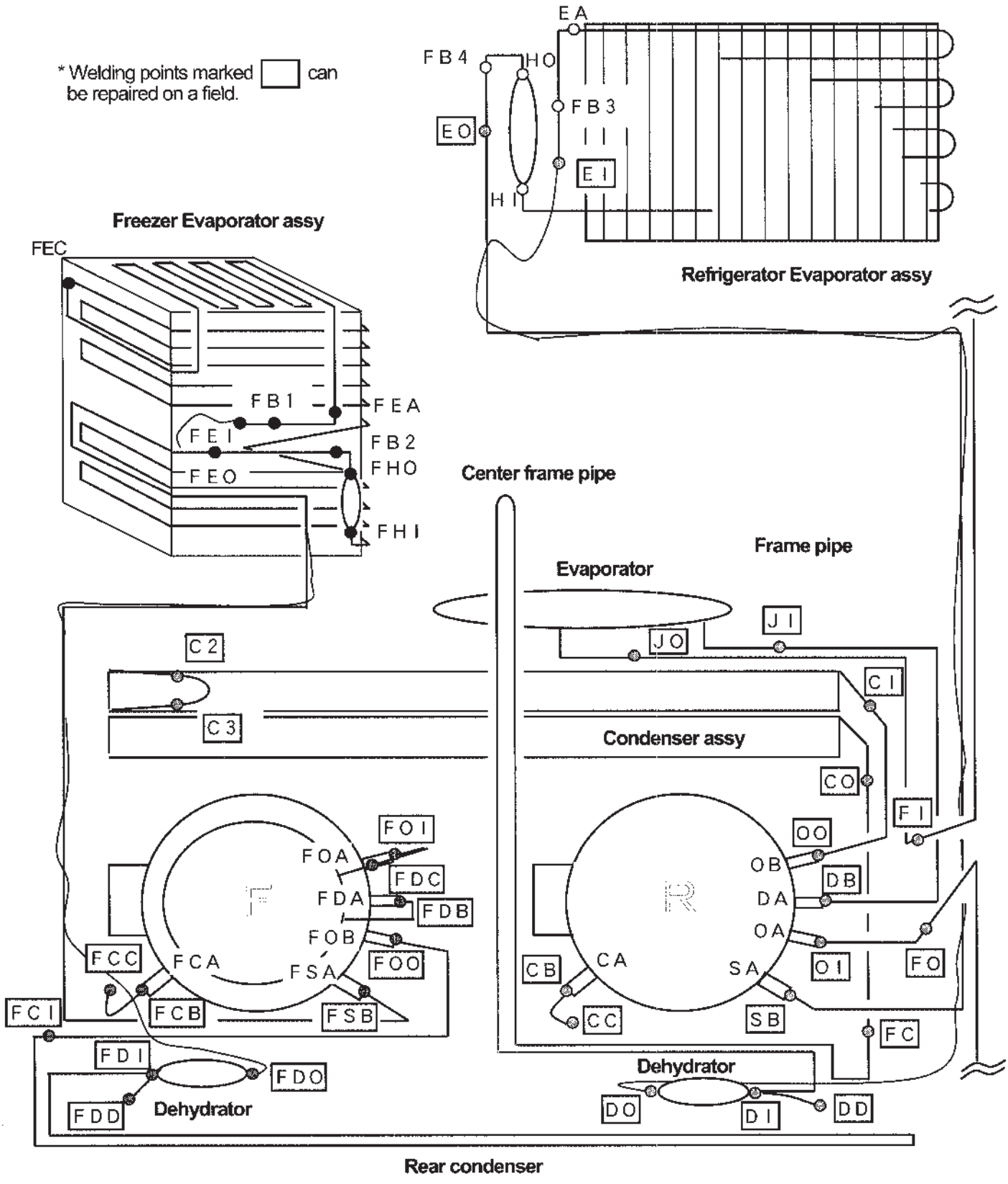


MPR-414F Refrigerator



Refrigeration circuit welding points

* Welding points marked ☐ can be repaired on a field.



Control specification

1. Keys and switches

BZ	With ALARM lamp flashing and the buzzer sound on Buzzer and remote alarm output ------- forced off With ALARM lamp flashing and the buzzer sound off Buzzer does not sound
SET	When the key pressed once, the device goes into Setting Mode. In one more time pressed, the settings are stored (i.e. has an Enter key function).
REF. / FREEZ.	Press the key to switch operation from (to) refrigerator to (from) freezer. Every time press the key to switch operation. This key is operative only in the internal temperature (PV) mode.
▶▶	In Setting Mode, moves between the first and second places. i.e. 10 ⇔ 1 Put the device into Lock Mode ("L0" display) if pressed continuously for 5 seconds or more when the internal temperature is displayed.
▲▲	In Setting Mode, counts up through the flashing digits. The device goes into Function mode ("F00" display) if this key is pressed continuously for 5 seconds or more when the internal temperature is displayed.

2. Temperature control

Setting range	+2℃ to +14℃ for refrigerator -35℃ to -15℃ for freezer
Display range	-50℃ to +50℃
Setting method	First select operation mode in REF./FREEZ. key. Press the SET key and adjust the setting to the desired temperature using the ▲▲ key and ▶▶ key. Press SET key again to store the adjusted setting, exit Setting Mode and return to the current temperature display.
Outside the range	If the SET key is pressed when the setting has been changed to a value outside setting range, the buzzer sounds (continuously) for 1 second and the device remains in Setting Mode.

3. Alarms

High-temperature Alarm	If the internal temperature is higher than the SV, ALARM lamp flashes, the numeric display flashes, the buzzer sounds (intermittently) after an approximately 15 minute delay and remote alarm output is switched on (initial value: SV+5℃ for refrigerator, SV+10℃ for freezer).
Low-temperature alarm	If the internal temperature is lower than the SV, ALARM lamp flashes, the numeric display flashes, the buzzer sounds (intermittently) after an approximately 15 minutes delay and remote alarm output is switched on (initial value: SV-5℃ for refrigerator, SV-10℃ for freezer).

When the internal temp. is lower than 0℃

If the refrigerator temperature sensor is 0℃ or lower, immediately ALARM lamp flashes, the numeric display flashes, the intermittent buzzer sounds without delay and remote alarm output is switched on.

Setting method

Press ⏫ key continuously for 5 seconds or more to go into Function mode (“F00” is displayed), then press ⏫ key to count up through the numbers. A value for high temperature alarm to be input if “F01” is selected, and a value for low-temperature alarm to be input if “F02” is selected. Select one of these and press the SET key to go into Alarm Temperature Setting Mode, where the setting is adjusted to the desired value using ⏩ and ⏫ keys. When the SET key is pressed, the adjusted temperature is stored.

Outside the range:

If the SET key is pressed after the setting has been changed to a value out of the setting range, the buzzer sounds (continuously) for 1sec and the device remains same.

4. Defrosting

Refrigerator

Defrost starts when the temperature sensed in DEF sensor comes to following conditions:

1) Normal defrost
   Defrost starts at: -13℃
   Defrost stops at: +5℃
   Defrost starts/stops automatically.
   “dF” and the internal temperature are displayed alternately during defrost.
   A temperature alarm is canceled during defrost.
2) Defrost is forced to stop operation when the temperature sensed in temperature sensor goes higher than SV+7℃.
   However, if it is forced to stop twice sequentially, the next time stops normally.
3) Defrost starts when the compressor runs 3~4hours continuously and at the same time, the temperature sensed in DEF sensor comes lower than 0℃.
   Defrost stops when the temperature sensed in DEF sensor rises to +5℃.

Freezer

The compressor stops when SV is “-00”.
Defrost starts/stops manually.
“dF” and the internal temperature are displayed alternately during defrost.
A temperature alarm is canceled during defrost.
Change SV to restart freezer operation.
Even if a power failure is occurred or the main power is OFF during defrost, the apparatus keeps defrost operation after the main power is recovered. (SV still remains 0℃)

5. Self-Diagnostic Functions

E01: Temperature sensor in refrigerator open circuit
E02: Temperature sensor in refrigerator short circuit
E03: Temperature sensor in freezer open circuit
E04: Temperature sensor in freezer short circuit
E05: DEF sensor open circuit
E06: DEF sensor short circuit

In the temperature sensor open circuit, “E01” and “-50℃” are displayed alternately.
In the temperature sensor short circuit, “E02” and “+50℃” are displayed alternately.
In –60℃ for temperature conversion, it is regarded as open circuit.
In +60℃ for temperature conversion, it is regarded as short circuit.

Protections for sensor error

1) E01, E02
   If the refrigerator temperature sensor is malfunctioned, DEF sensor controls the temperature instead of the refrigerator temperature sensor.
   When the temperature detected by DEF sensor is:
   0℃ = the compressor will be turned off.
   7℃ = the compressor will be turned on.
2) E03, E04
   The compressor in freezer runs continuously.
3) E05, E06
   Defrost is inoperative.

6. Lock Functions

Lock mode: If ⏩ key is pressed continuously for 5seconds or more when the current internal temperature is displayed, the device goes into Lock Mode and “L0” is displayed.
Press ⏫ to select 1 ----- Lock on
0 ----- Lock off
Then press the SET key to store the setting and revert the display to the internal temperature.

Note) In Lock ON, the device enters into SET mode but the value remains unchanged.

7. Auto-return

Function: If there is no key operation for around 90seconds or more in Setting Mode, Lock Mode or Function Mode, the device automatically exits the current mode and reverts to displaying the current internal temperature without storing the value being modified at the time.

Note) Auto-return is inoperative in F09, F10 (Line test mode).

8. Compressor delay

During the cycle, the compressor is forcibly switched off 2minutes after the compressor is forcibly switched off.
Compressor delay time is varied when the main power is supplied (the microcomputer resets). (See F05)
The compressor in freezer starts 15seconds earlier than the compressor in refrigerator. During the cycle, one of those compressor starts 9seconds earlier than another.

9. Function Mode: Function Mode includes the following functions.

F00: Simply reverts to the PV display (if entered in error)
F01: Change the temperature at which the high-temperature alarm activates (in refrigerator)
F02: Change the temperature at which the low-temperature alarm activates (in refrigerator)
F03: Change the temperature at which the high-temperature alarm activates (in freezer)
F04: Change the temperature at which the low-temperature alarm activates (in freezer)
F05: Compressor delay time set
F06: Service code input (Code:384)
F07: Refrigerator temperature sensor Zero adjustment
(±9.9℃ by differential input)
F08: Freezer temperature sensor Zero adjustment
(±9.9℃ by differential input)
F09: Line Test Mode (reach)
F10: Line Test Mode (program)
F11: Unassigned
F12: The temperature sensed in refrigerator temp sensor is displayed. (unit of 0.1℃)
F13: The temperature sensed in DEF sensor is displayed. (unit of 1℃)
F14: The temperature sensed in freezer temp sensor is displayed. (unit of 0.1℃)
F15: A temperature sensed in temp sensor 3 is displayed. (unit of 1℃)
⇨ Unassigned in this model.
F16: Unassigned
F17: A model code set
001: MPR-414F
002: Unassigned
F18: Unassigned
F19: Unassigned
F20: Unassigned
F21: Communication ID set (000~255)
F22: Communication mode set
F23: Unassigned
F24: Remote alarm buzzer connection mode set
F25: Ring-back time set
F26: Unassigned
F27: Unassigned
F28: Unassigned
F29: Unassigned
F30: ROM version display

Direction for Use:

If ⏫ key is pressed continuously for 5seconds or more when the current internal temperature is displayed, the device goes into Function Mode and “F00” is displayed. Press ⏫ key, enter the desired code and press the SET key.

F00: Have no function. The device reverts to the current (PV) internal temperature display if the SET key is pressed when F00 and F09 are displayed.

F01: Allows the refrigerator high-temperature alarm SV to be set up in the range +2℃ to +14℃. The initial value is +5℃.

F02: Allows the refrigerator low-temperature alarm SV to be set up in the range –2℃ to -14℃. The initial value is –5℃.

F03: Allows the freezer high-temperature alarm SV to be set up in the range +5℃ to +15℃. The initial value is +10℃.

F04: Allows the freezer low-temperature alarm SV to be set up in the range –5℃ to –15℃. The initial value is –10℃.

F05: Compressor delay time set. (This mode is assigned only in the main power supplied or microcomputer reset)
The function is assigned to reduce the compressor starting-up malfunctions or the breaker blown outs when numbers of product start-up simultaneously after a power failure occurred. The delay time can be set by 1~15minutes. Initial setting is 1minute.
1minute for initial setting is stored in the memory after F10 (Line test mode) is performed. The delay time is set by 3seconds prior to F10 is performed. When the PCB is changed on servicing, the time lag is also 3seconds.

F06: When F07 or larger number function is used, the following service code should be input with ⏫ key and ⏭ key.
Press SET key to memorize the code then the device is entered into Function mode again. As an exceptionally case, a value for F21 or F22 or F25 for Communication parameter set can be changed without inputting the service code.
Service code: 384

Note 1) Above code is not stored if “000” is input again in “F06” or the main power is OFF.

2) If a smaller numerical digit is set in F01, an alarm would be occasionally triggered during defrost.

F07: Refrigerator temperature sensor Zero adjustment
(The range: -9.9℃ ~ +9.9℃)
In “F07” display, press SET key to be appeared “00.0” (initial value). Change to a desired value with ⏫ key and ⏭ key then press SET key again to memorize it. Differential input should be done.

Ex) If the 1/2H actual temperature is 4.2℃ when SV is 5.0℃, the device is added –0.8 (4.2-(5.0)) to the value displayed in F07.
However, ⏫ key can be only used to change “0” and “-“ in the second place before the decimal point. Figures from “0” to “9” can be changed in the first place before the decimal point and the first place after the decimal point. The ⏭ key allows to move between the places inn the sequence 10 ⇆1 ⇆ 0.1 ⇆ 10.

F08: Freezer temperature sensor Zero adjustment
(The range is: -9.9℃ ~ +9.9℃)
In “F08” display, press SET key to be appeared “00.0” (initial value). Change to a desired value with ⏫ key and ⏭ key then press SET key again to memorize it. Differential input should be done.

F09: Line test mode (reach)
The function is for temperature reach test, the compressor is forced to turn on with regardless of SV. (without delay)
In “F09” display (the digit blinks), press SET key to show “F09” and the current internal temperature alternately.
(90seconds Auto Return function is not worked)
Press SET key to return to PV display.

Note) In F09 is performed, high/low temperature alarm is not worked.

F10: Line test mode (program)
For refrigerator: Operate 1.5hours in –10℃ set → 1.5hours in 5℃ set → end in 5℃
For freezer: Operate 1.5hours in –45℃ set → 1.5hours in –30℃ set → change SV to -20℃ → end
In “F10” display (the digit blinks), press SET key to show “F10” and the current internal temperature alternately.
(90seconds Auto Return function is not worked)
The test mode automatically comes to end after 3hours has passed since the program had set.
Press SET key to return to PV display.
SV is forced to be changed to 5℃ for refrigerator and –20℃ for freezer with regardless of the SV before F10 is performed.
1minute for compressor delay time is set.
If the power switch is OFF or a power failure is occurred, SV is not stored.

F12: A temperature sensed in refrigerator temperature sensor is displayed unit of 0.1℃.
The display gives the temperature to the first decimal place, but as the display area is 3-digit, the “-“ in minus temperatures is not displayed in –20℃ or lower. (For example, an actual temperature of –35.0 would be displayed as 35.0℃).
However, the “-“ is displayed from –19.9℃ to –0.1℃.

F13: A temperature sensed in DEF sensor is displayed unit of 1℃.

F14: A temperature sensed in freezer temperature sensor is displayed unit of 0.1℃.
The display gives the temperature to the first decimal place, but as the display area is 3-digit, the "-" in minus temperatures is not displayed in –20℃ or lower. (For example, an actual temperature of –35.0 would be displayed as 35.0℃).
However, the "-" is displayed from –19.9℃ to –0.1℃.

F15: A temperature sensed in sub temperature sensor 3 is displayed unit of 1℃. The display range: -50℃ ~ +110℃
⇨ Unassigned in this model.

F17: A model code to be set.
001: MPR-414F
002: MPR-214F
In "F17" display, press SET key to be appeared "001" (initial set). Change the value with ⏫ key and press SET key again to store it.
Initial setting values are follow :
Refrigerator : 5℃
Freezer : -20℃
Key lock mode : L0 (OFF)
Refrigerator high temp alarm : SV+5℃
Refrigerator low temp alarm : SV-5℃
Freezer high temp alarm : SV+10℃
Freezer low temp alarm : SV-10℃
Refrigerator zero adjustment : 0℃
Freezer zero adjustment : 0℃
Communication ID : 000
Communication mode : 000
Ring back time : 030（30minutes）
Remote alarm linkage: Not linked

F21: Serial communication ID set
Input range: 000 ~ 255 (000 = communication OFF)

F22: Serial communication mode set
Control mode (the 3rd digit) 0 : local (initial setting)
1: remote
Baud rate (the 2nd digit) 0 : 2400 bps (initial setting)
1: 4800 bps
2: 9600 bps
The 1st digit is unassigned.

Note) Once the control mode is set to "remote", you cannot change SV.

F24: Remote alarm interlock
000 : Not interlocked (on factory outgoing)
001 : Interlocked

F25: Ring Back time is set.
Input range: 000, 010, 020, 030, 040, 050, 060 (unit of minute)
000 = Ring Back is not worked.

F30: ROM version is displayed.

10. Differential (COMP ON and OFF points in relation to settings):

	Refrigerator	**Freezer**
COMP ON	SV+0.3℃ or higher	SV+0.4℃ or higher
COMP OFF	SV-0.3℃ or lower	SV-0.4℃ or lower

11. Offset value: The device is offset as follows in order to correct the differential between the temperature detected by the sensor and the temperature in geometrical center of internal chamber.

	MPR-414F
Refrigerator offset value	Temperature detected –1.2℃
Freezer offset value	Temperature detected –3.0℃

12. Remote Alarm The Remote Alarm Contact is:
Open: During normal operation
Closed: During an alarm or/and power failure

Electrical Parts

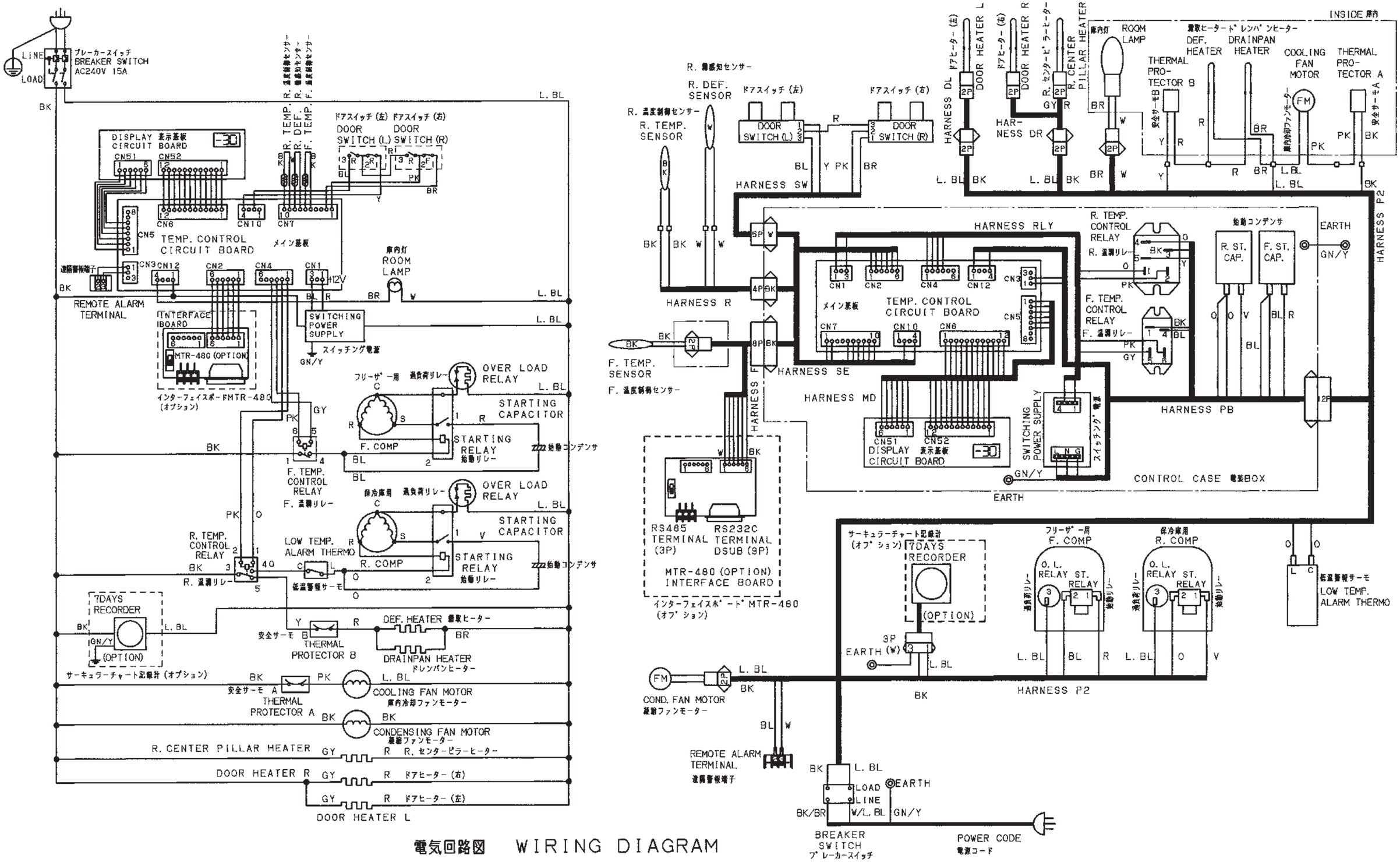
MPR-414F,414FR		AC110V,60Hz	AC115V,60Hz	AC220V,50Hz	AC220V,60Hz	AC230V,50Hz	AC240V,50Hz
Compressor	Type	C-B161L9W	C-B161L9W	C-B160L6V	C-B160L6V	C-B160L5V	C-B160L5V
	Code	801-165-19	801-165-19	801-161-16	801-161-16	801-161-15	801-161-15
	Rated voltage (50/60Hz)	110/115V (50/60Hz)	110/115V (50/60Hz)	220V(50/60Hz)	220V(50/60Hz)	220/230/240V(50Hz)	220/230/240V(50Hz)
	Winding resistance C-S(Aux)	2.063Ω	2.063Ω	10.28Ω	10.28Ω	13.67Ω	13.67Ω
	C-R(Main)	7.474Ω	7.474Ω	62.95Ω	62.95Ω	65.24Ω	65.24Ω
Starting relay	Type	S85C	S85C	S38C	S38C	S32C	S32C
	Code	4-2239-626-52	4-2239-626-52	4-2329-626-59	4-2329-626-59	4-2239-626-26	4-2239-626-26
	Pick up voltage	8.5A or less	8.5A or less	3.8A or less	3.8A or less	3.2A or less	3.2A or less
	Drop out voltage	7.4A or more	7.4A or more	3.3A or more	3.3A or more	2.8A or more	2.8A or more
Overload relay	Type	P15KS	P15KS	P72HS	P72HS	P63AS	P63AS
	Code	4-2329-645-01-3	4-2329-645-01-3	4-2329-470-81	4-2329-470-81	4-2329-644-97	4-2329-644-97
	Action to the temp. OFF	150±10℃	150±10℃	130±8℃	130±8℃	120±10℃	120±10℃
	ON	85±10℃	85±10℃	65+10℃,−5℃	65+10℃,−5℃	69±10℃	69±10℃
	Action to the current	(No load, AT80℃)	(No load, AT80℃)	(No load, AT80℃)	(No load, AT80℃)	(No load, AT80℃)	(No load, AT80℃)
	ON	5.1A	5.1A	2.0A	2.0A	1.7A	1.7A
	OFF	3.8A	3.8A	1.5A	1.5A	1.2A	1.2A
Starting capacitor	Code	4-2239-603-27	4-2239-603-27	4-2239-603-32	4-2239-603-32	4-2239-603-32	4-2239-603-32
	Rating	150μ, 160VAC	150μ, 160VAC	40μ, 300VAC	40μ, 300VAC	40μ, 300VAC	40μ, 300VAC
Cooling fan motor	Type	FL2-011B1M	FL2-011B1M	FL2-012BM5	FL2-012BM5	FL2-012BM5	FL2-012BM5
	Code	524-0-8201	524-0-8201	524-0-8215	524-0-8215	524-0-8215	524-0-8215
	Rating	110V, 1W	110V, 1W	230V, 1W	230V, 1W	230V, 1W	230V, 1W
Condenser fan motor	Type	FL2-021R1M	FL2-021R1M	FL2-021R5M	FL2-021R5M	FL2-021R5M	FL2-021R5M
	Code	7FB-4-M102-030-01	7FB-4-M102-030-01	7FB-4-M102-030-05	7FB-4-M102-030-05	7FB-4-M102-030-05	7FB-4-M102-030-05
	Rating	110V, 2W	110V, 2W	230V, 2W	230V, 2W	230V, 2W	230V, 2W
Door heater	Code	7FB-4-H101-096-02	7FB-4-H101-096-02	7FB-4-H101-096-03	7FB-4-H101-096-03	7FB-4-H101-096-03	7FB-4-H101-096-03
	Rating	115V, 7.2W 1,843Ω(AT25℃)	115V, 7.2W 1,843Ω(AT25℃)	230V, 7.5W 7,053Ω(AT25℃)	230V, 7.5W 7,053Ω(AT25℃)	230V, 7.5W 7,053Ω(AT25℃)	230V, 7.5W 7,053Ω(AT25℃)
R center pillar heater	Code	7FB-4-H101-022-01	7FB-4-H101-022-01	7FB-4-H101-022-00	7FB-4-H101-022-00	7FB-4-H101-022-00	7FB-4-H101-022-00
	Rating	115V, 6W 2,204Ω(AT25℃)	115V, 6W 2,204Ω(AT25℃)	230V, 6W 8,817Ω(AT25℃)	230V, 6W 8,817Ω(AT25℃)	230V, 6W 8,817Ω(AT25℃)	230V, 6W 8,817Ω(AT25℃)
Defrost heater	Code	823-2-5171-001-13	823-2-5171-001-13	823-2-5171-001-20	823-2-5171-001-20	823-2-5171-001-20	823-2-5171-001-20
	Rating	109V, 82W 145Ω(AT25℃)	109V, 82W 145Ω(AT25℃)	207V, 82W 524Ω(AT25℃)	207V, 82W 524Ω(AT25℃)	207V, 82W 524Ω(AT25℃)	207V, 82W 524Ω(AT25℃)
Drain pan heater	Code	823-2-5171-021-01	823-2-5171-021-01	823-2-5171-021-05	823-2-5171-021-05	823-2-5171-021-05	823-2-5171-021-05
	Rating	115V, 39W 340Ω(AT25℃)	115V, 39W 340Ω(AT25℃)	230V, 39W 1,360Ω(AT25℃)	230V, 39W 1,360Ω(AT25℃)	230V, 39W 1,360Ω(AT25℃)	230V, 39W 1,360Ω(AT25℃)
Low temp. alarm thermostat	Type	ATB-S1176	ATB-S1176	ATB-S1176	ATB-S1176	ATB-S1176	ATB-S1176
	Code	7FB-4-S401-031-00	7FB-4-S401-031-00	7FB-4-S401-031-00	7FB-4-S401-031-00	7FB-4-S401-031-00	7FB-4-S401-031-00
	ON	6℃	6℃	6℃	6℃	6℃	6℃
	OFF	−1℃	−1℃	−1℃	−1℃	-1℃	-1℃
Thermal protector A	Type	TH-2	TH-2	TH-2	TH-2	TH-2	TH-2
	Code	823-2-5102-105-02	823-2-5102-105-02	823-2-5102-105-02	823-2-5102-105-02	823-2-5102-105-02	823-2-5102-105-02
	ON	18℃	18℃	18℃	18℃	18℃	18℃
	OFF	28℃	28℃	28℃	28℃	28℃	28℃
Thermal protector B	Type	TH-2	TH-2	TH-2	TH-2	TH-2	TH-2
	Code	823-2-5102-105-03	823-2-5102-105-03	823-2-5102-105-03	823-2-5102-105-03	823-2-5102-105-03	823-2-5102-105-03
	ON	18℃	18℃	18℃	18℃	18℃	18℃
	OFF	28℃	28℃	28℃	28℃	28℃	28℃
Bulb	Type	E12/15	E12/15	E12/15	E12/15	E12/15	E12/15
	Rating	125V, 10W	125V, 10W	250V, 15W	250V, 15W	250V, 15W	250V, 15W
Temperature sensor	Type	502AT-1	502AT-1	502AT-1	502AT-1	502AT-1	502AT-1
	Code	823-2-5108-124-00	823-2-5108-124-00	823-2-5108-124-00	823-2-5108-124-00	823-2-5108-124-00	823-2-5108-124-00
Defrost sensor	Type	502AT-1	502AT-1	502AT-1	502AT-1	502AT-1	502AT-1
	Code	7FB-0-R501-011-00	7FB-0-R501-011-00	7FB-0-R501-011-00	7FB-0-R501-011-00	7FB-0-R501-011-00	7FB-0-R501-011-00
Door switch	Type	S947	S947	S947	S947	S947	S947
	Code	7FB-4-S101-031-00	7FB-4-S101-031-00	7FB-4-S101-031-00	7FB-4-S101-031-00	7FB-4-S101-031-00	7FB-4-S101-031-00
	Rating	125VAC, 0.1A	125VAC, 0.1A	125VAC, 0.1A	125VAC, 0.1A	125VAC, 0.1A	125VAC, 0.1A

Specifications of sensor

The following shows temperature and resistance characteristics on each thermistor sensor (type 502AT-1).

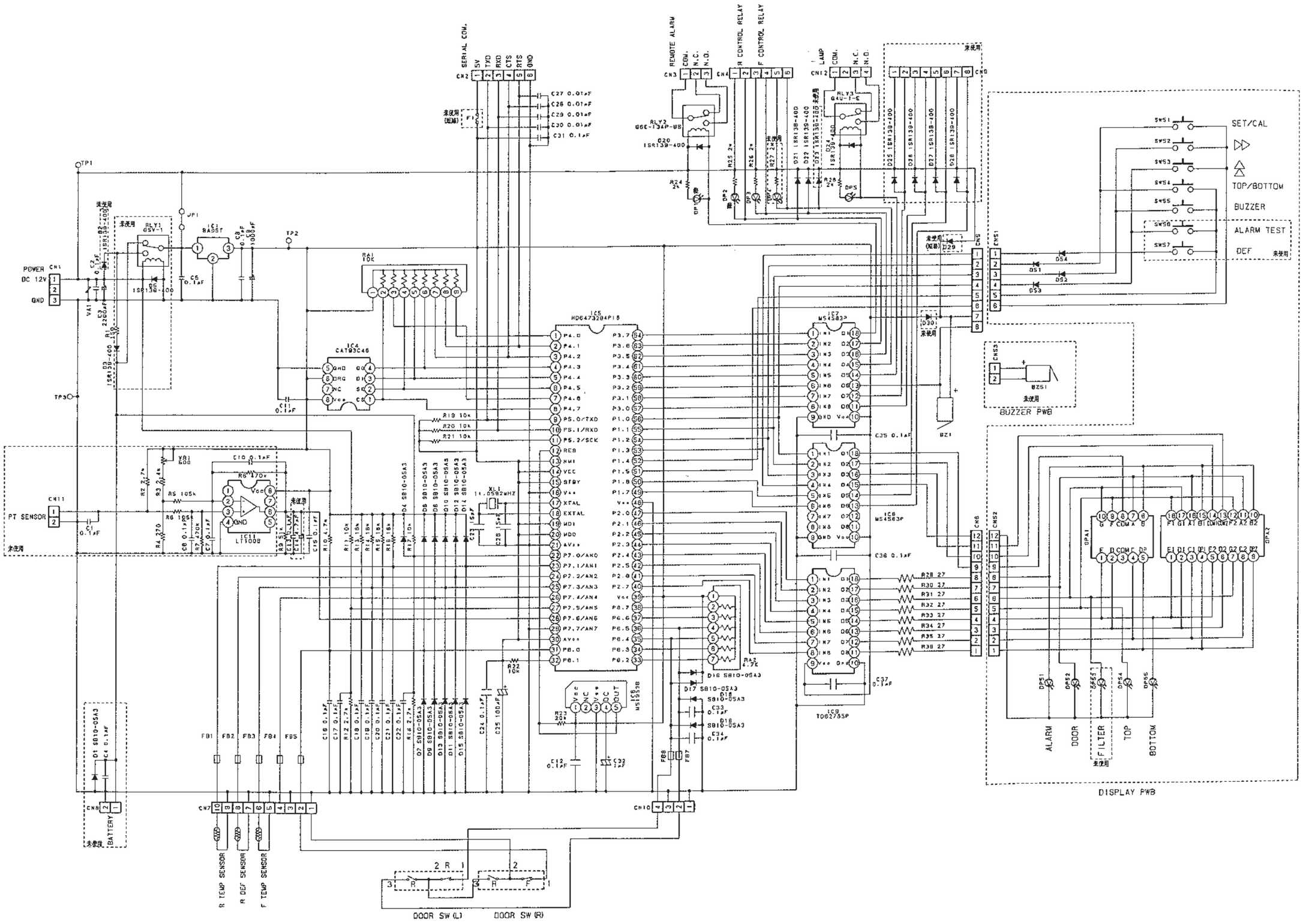
Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)
−50	154.50	−7	17.92	12	8.17
−45	116.50	−6	17.16	13	7.85
−40	88.85	−5	16.43	14	7.55
−35	68.15	−4	15.74	15	7.27
−30	52.84	−3	15.08	16	6.99
−25	41.19	−2	14.45	17	6.73
−20	32.43	−1	13.86	18	6.48
−19	30.92	0	13.29	19	6.24
−18	29.50	1	12.74	20	6.01
−17	28.14	2	12.22	25	5.00
−16	26.87	3	11.72	30	4.18
−15	25.65	4	11.25	35	3.51
−14	24.51	5	10.80	40	2.96
−13	23.42	6	10.37	45	2.51
−12	22.39	7	9.96	50	2.14
−11	21.41	8	9.57	55	1.83
−10	20.48	9	9.20	60	1.57
−9	19.58	10	8.84		
−8	18.73	11	8.49		

Wiring Diagram

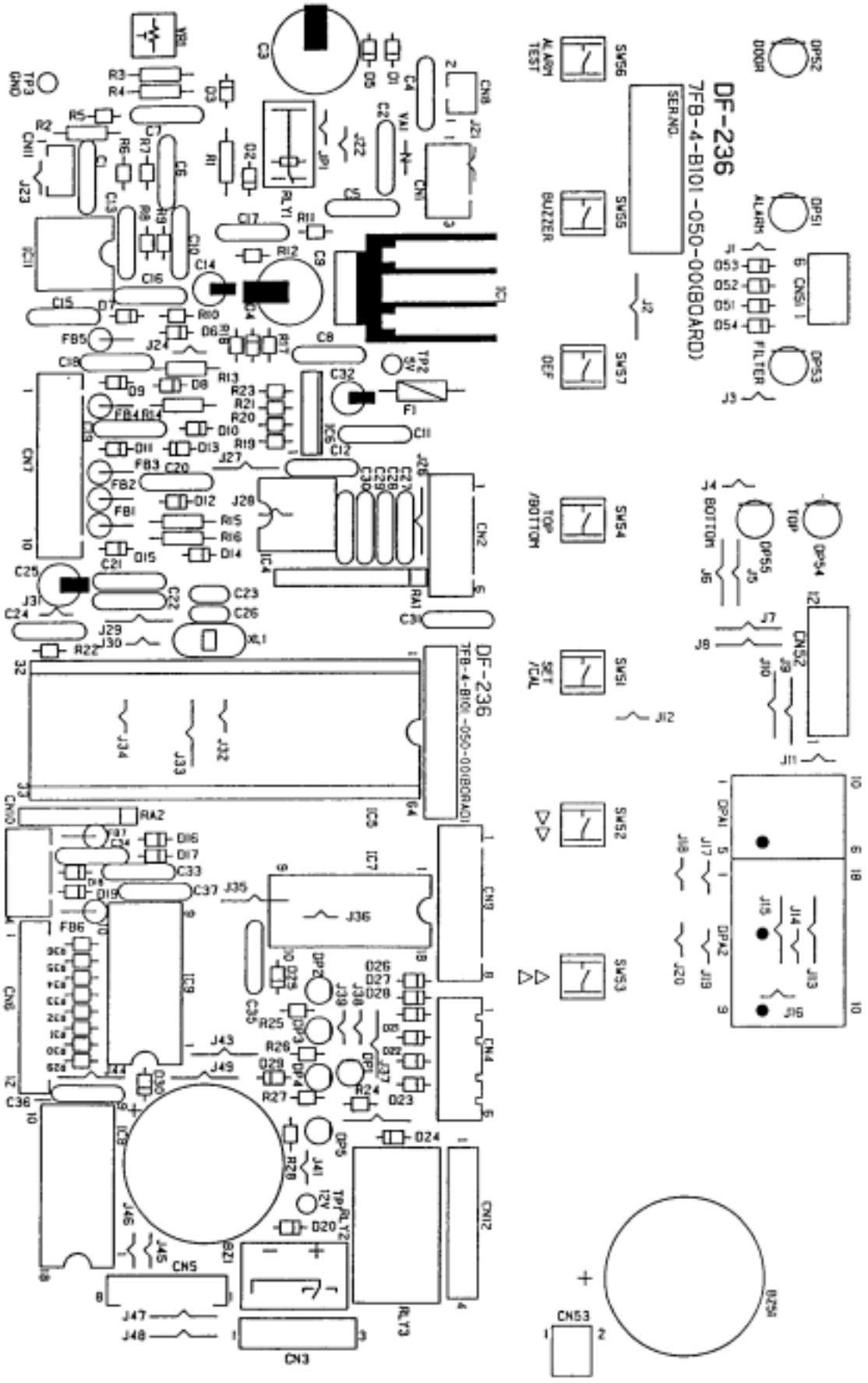


電気回路図　WIRING DIAGRAM

Circuit Diagram



Components on PCB



Connection on PCB

The following shows connections of connector (CN) on control PCB.

Connector	Connects to	Use
CN1	Switching power supply #1 +12VDC #3 GND	Power supply to PCB.
CN2	Interface board	MTR-480 for optional connection
CN3	Remote alarm terminal ・#1 COM ・#2 N.C (under no power) ・#3 N.O (under no power)	N.O.-COM (in temperature alarm activating, and during a power failure)
CN4	Temperature control relay coil #1, #2 To control refrigerator #3, #4 To control freezer #5, #6 Unassigned	Turn temperature control relay on / off.
CN5	Display Circuit Board	Connects to Display Control Board.
CN6	Display Circuit Board	Connects to Display Control Board.
CN7	Door switch and sensors #1, #2 Door switch #3, #4 Unassigned #5, #6 Freezer temperature sensor #7, #8 Refrigerator DEF. sensor #9, #10 Refrigerator temp. sensor	Input from door switch and sensors
CN8	Unassigned	
CN9	Unassigned	
CN10	Door switch	
CN11	Unassigned	
CN12	Room lamp #1 COM #2 Unassigned #3 N.C #4 N.O	Room lamp to be turned on/off.

Test data

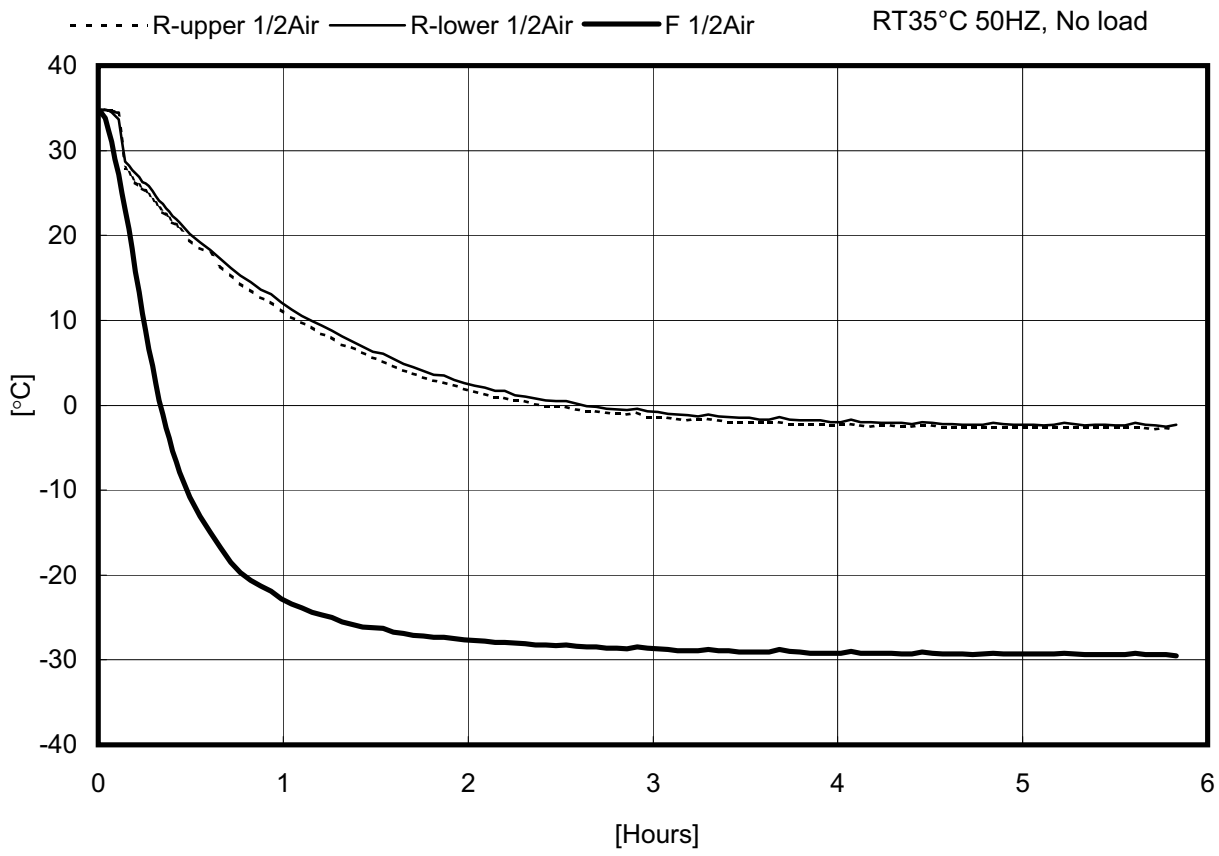
1. MPR-414F, FR, FS, FRS
   ①Reach temperature
   ②Pull-down characteristics (internal temperature)
   ③Pull-down characteristics (pressure)
   ④Pull-down characteristics (consumption)
   ⑤Pull-up characteristics (internal temperature)
   ⑥Temperature distribution characteristics（reference data）

◊MPR-414F Reach temperature(reference data)

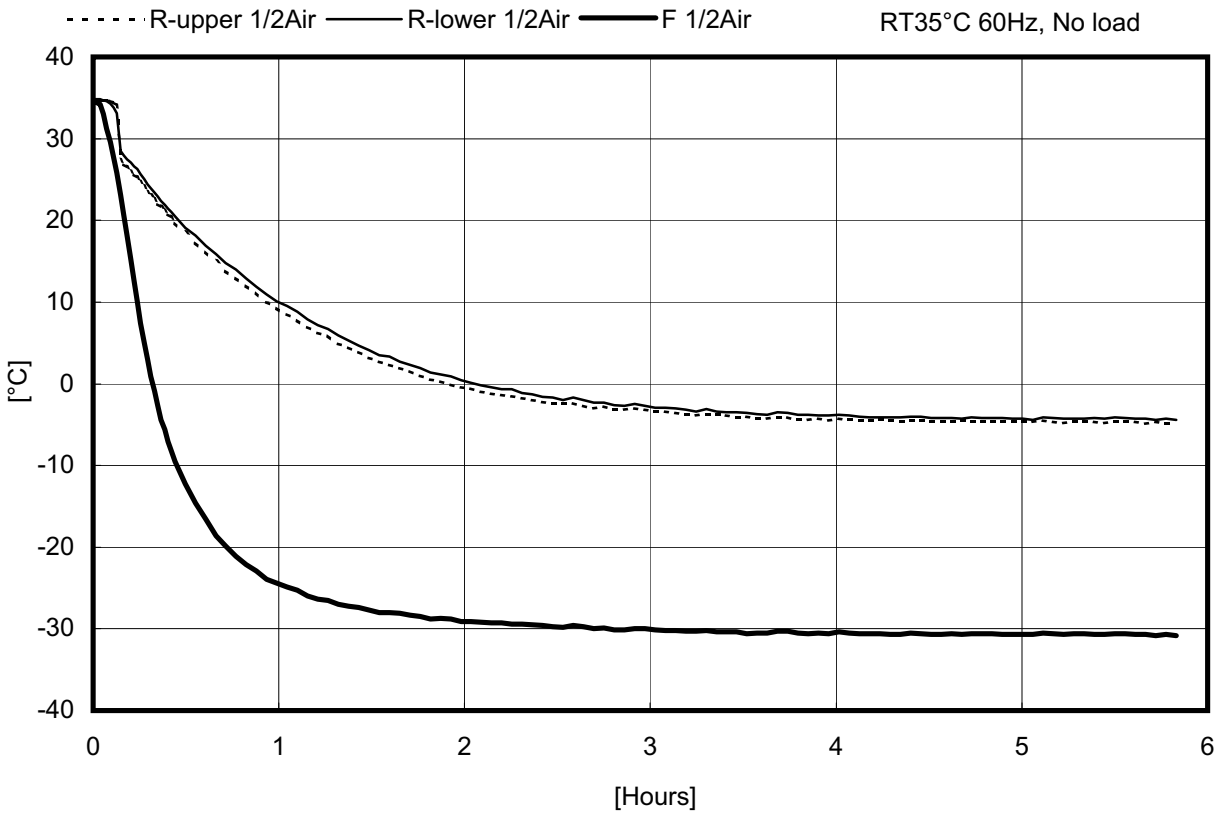
		AT 30°C		AT 35°C	
		50Hz	60Hz	50Hz	60Hz
Refrigerator	Compressor case lower [°C]	61.5	65.5	68.5	72.9
	Discharge pipe [°C]	81.5	82.8	92.6	96.6
	Dehyderator entrance pipe [°C]	38.7	38.8	47.7	48.0
	Evaporator entrance [°C]	-17.3	-19.6	-10.8	-12.8
	Evaporator center [°C]	-17.3	-19.7	-11.4	-13.6
	Evaporator exit [°C]	-17.6	-20.0	-11.4	-13.6
	Header exit [°C]	-16.5	-19.4	-10.4	-12.7
	Suction pipe [°C]	26.9	26.7	33.3	33.2
	Upper chamber 1/2H air [°C]	-9.2	-11.2	-2.9	-4.7
	Lower chamber 1/2H air [°C]	-8.8	-10.8	-2.4	-4.3
Freezer	Compressor case lower [°C]	86.2	87.6	77.5	91.2
	Discharge pipe [°C]	84.3	85.3	77.6	89.6
	Dehyderator entrance pipe [°C]	36.5	36.7	40.7	38.8
	Evaporator entrance [°C]	-40.4	-41.5	-39.3	-40.5
	Evaporator center [°C]	-37.2	-38.1	-36.4	-36.5
	Evaporator exit [°C]	-35.5	-36.5	-36.9	-34.9
	Header exit [°C]	-36.4	-37.4	-37.0	-35.7
	Suction pipe [°C]	25.0	24.9	36.3	27.7
	Internal 1/2H air [°C]	-32.1	-33.0	-31.3	-30.7

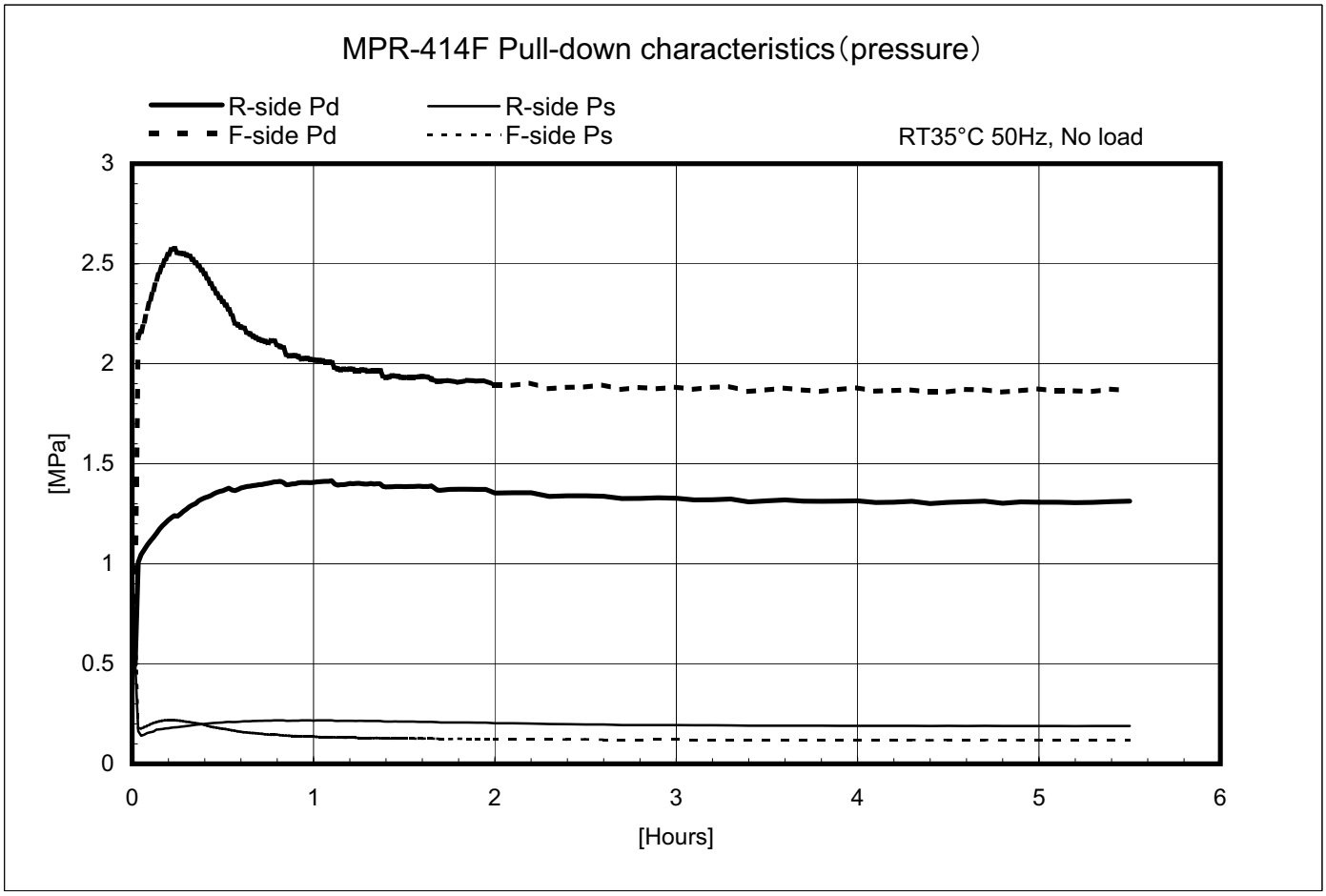
■Test data

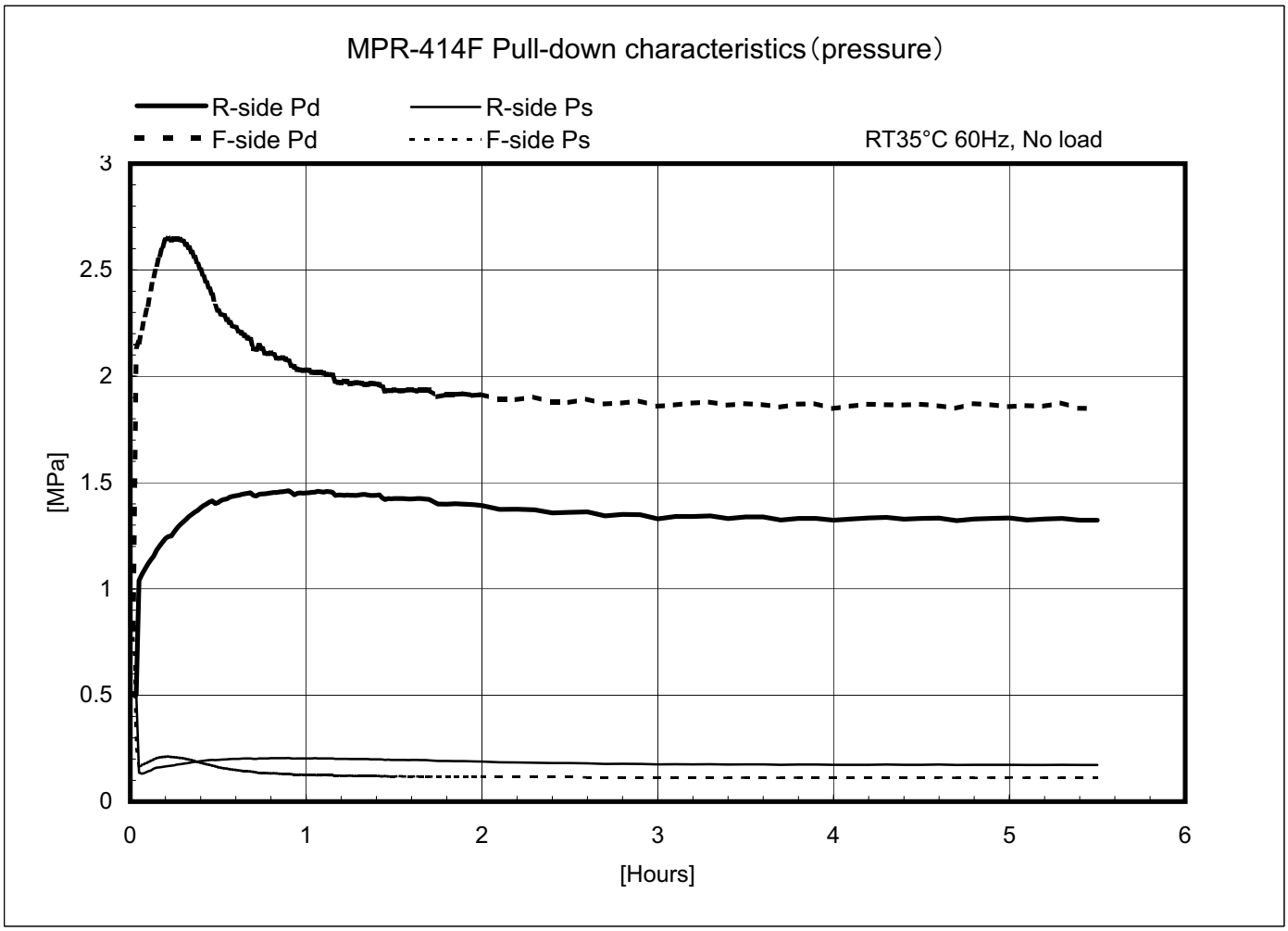
MPR-414F Pull-down characteristics（internal temperature)



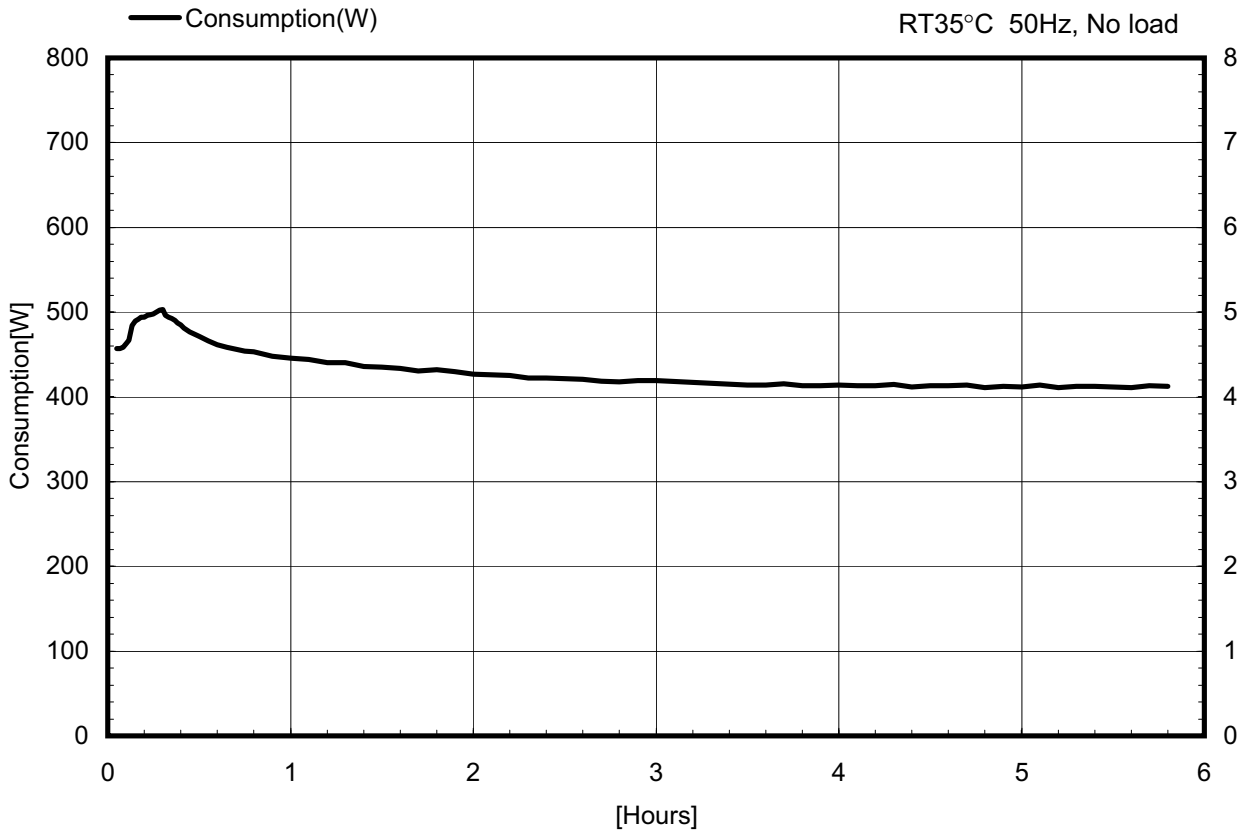
MPR-414F Pull-down characteristics（internal temperature)



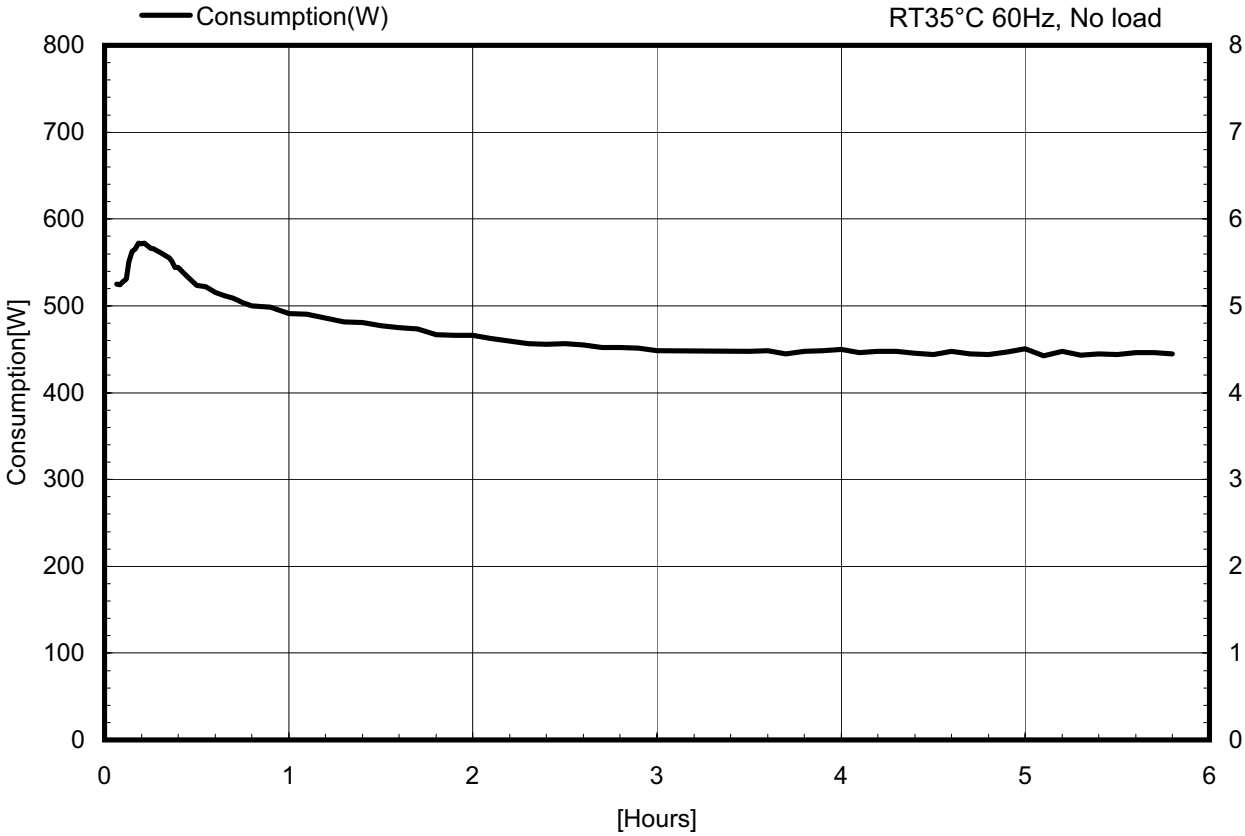

MPR-414F Pull-down characteristics（pressure）
R-side Pd
R-side Ps
F-side Pd
F-side Ps
RT35°C 50Hz, No load
[MPa]
[Hours]
0
0.5
1
1.5
2
2.5
3
0
1
2
3
4
5
6


MPR-414F Pull-down characteristics（pressure）
R-side Pd
R-side Ps
F-side Pd
F-side Ps
RT35°C 60Hz, No load
[MPa]
[Hours]
0
0.5
1
1.5
2
2.5
3
0
1
2
3
4
5
6

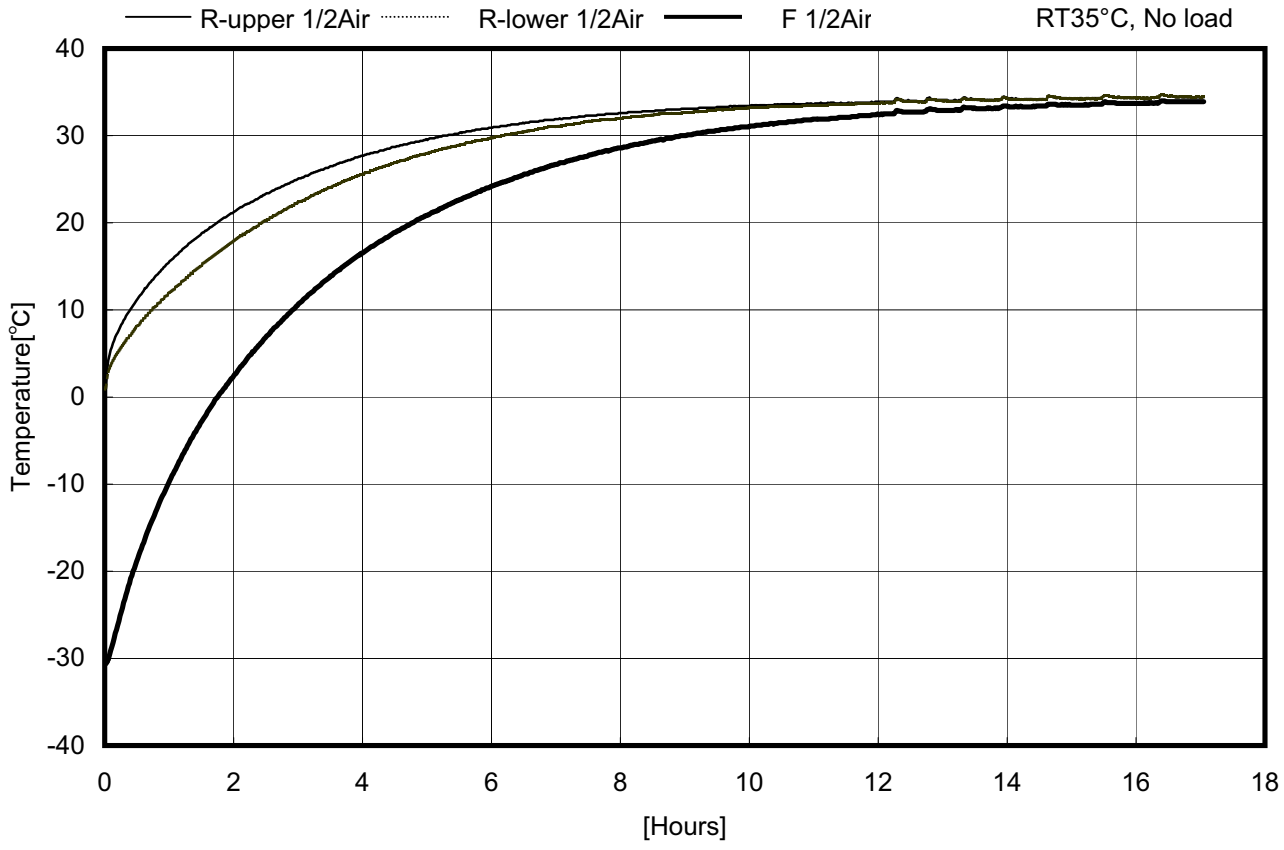
MPR-414F Pull-down characteristics（consumption）



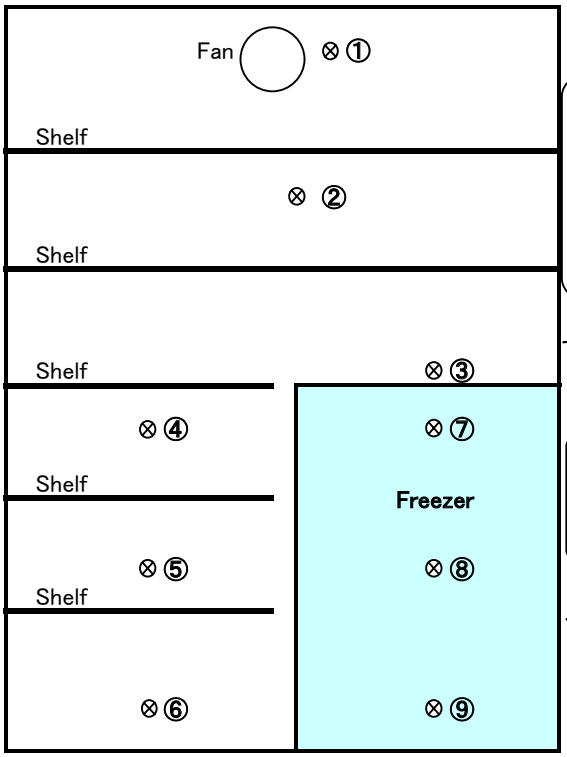
MPR-414F Pull-down characteristics（consumption）



MPR-414F Pull-up characteristics（internal temperature）



◇MPR-414F Internal temperature distribution



≪Points to be temperature measured≫

Refrigerator
①Top, upper chamber: 50mm below the top wall
②Middle, upper chamber: Geometrical center point in upper chamber
③Bottom, upper chamber: 50mm above the bottom (above the freezer)
④Top, lower chamber: 50mm below the lower shelf in upper chamber
⑤Middle, lower chamber: Geometrical center point in lower chamber
⑥Bottom, lower chamber: 50mm above the bottom in lower chamber

Freezer
⑦Top: 50mm below the freezer top wall
⑧Middle: Geometrical center point in the freezer
⑨Bottom: 50mm above on the bottom

≪Conditions≫
Local voltage
AT: 30℃
No load

Refrigerator	SV		
	2℃	5℃	14℃
①Top, upper chamber	2.9	5.7	15.0
②Middle, upper chamber	2.0	4.9	14.4
③Bottom, upper chamber	1.8	4.6	14.2
④Top, lower chamber	2.3	5.2	14.7
⑤Middle, lower chamber	1.9	4.9	14.4
⑥Bottom, lower chamber	1.6	4.6	14.2
Max.	2.9	5.7	15.0
Min.	1.6	4.6	14.2
Range *	±0.7	±0.6	±0.4

Freezer	SV	
	-30℃	-20℃
①Top	-27.0	-18.2
②Middle	-30.1	-21.3
③Bottom	-30.6	-21.7
Max.	-27.0	-18.2
Min.	-30.6	-21.7
Range *	±1.8	±1.8

* Range = ±{(Max. - Min.)/2}

Remarks) Above measured values are the reference that do not provide the assurence in products.